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THE GENUS TACHYDROMIA.[1]

By A. L. Melander, Pullman, Wash.

Concerning the application of the generic names *Coryneta, Tachydromia, Platypalpus, Tachypeza* and *Tachista* of the family Empididae there is much confusion. In his early paper, the Nouvelle classification des mouches à deux ailes, bearing the date 1800, Meigen gives his forty-fourth genus the name *Coryneta,* describing it as follows. "Antennes à deux articulations: la première petite, hérissée de poils; la seconde conique, terminée par un poil barbu. Trompe perpendiculaire. Cuisses des jambes du milieu enflées. Le tibia armé a l'extrêmité d'un piquant. Les ailes croisées."

No species of the genus are mentioned by name, but Meigen states that he has recognized three species. In 1803 in his revision of this paper in Illiger's Magazine, Meigen gave the name *Tachydromia* to the fifty-second genus, mentioning however this time two species, *cursitans* Fabricius and *cimicoides* Fabricius. His diagnosis of *Tachydromia* is as follows. "Die Fühlerhörner vorgestrekkt, zweigliederig: das erste Glied becherförmig; das zweite kegel-förmig in eine Borste auslaufend. Der Rüssel senk-recht. Schenkel der Mittelfüsse dikk, stachlig. Die Flügel flach parallel."

It will be noted that the two descriptions read much alike, which is why Bezzi (in lit.) and Hendel [2] have concluded that both refer to the same genus, and that therefore the older name *Coryneta* should be given preference. The Nouvelle Classification has been an extremely rare paper. But three copies are known to exist, one at the Academy of Natural Sciences, Philadelphia, a second owned by Professor Heyden, and another belonging to the late Osten Sacken, and now in the possession of Dr. Hendel. Because of the obscureness of this early paper of Meigen it has been neglected by all writers. Its names are not given in the nomenclators, and even Meigen himself ignored its

[1] Contribution from the Zoological Laboratory of the State College of Washington.
[2] Verhandl. k. k. zool.-bot. Gesellsch., Wien. 1908. pp. 43–69.

existence in his later works, as if ashamed of the curious meaningless names of his first publication. The diagnoses are brief, general and ambiguous, and, since no species are mentioned the identity of the genera would have remained mostly unknown, were it not that some of the early descriptions bear a similarity to the corresponding ones of the later paper. In nearly all cases however the generic names of 1800 are entirely different from those Meigen later used. The genera of Meigen's second contribution are well known, as for most of them typical species were cited at the beginning, and their names have been in constant usage for our commonest flies for more than a century. Even by this method of comparison and elimination many of the 1800 genera will never be understood.

This early publication of Meigen remained entirely ignored until Dr. F. Hendel republished it entirely in the Verhandlungen of the Wiener Gesellschaft. If we were to accept his guesses as to the identity of these early genera we would overthrow such well-known names as *Ceratopogon, Odontomyia, Eristalis,* etc., as well as the long established type-genera of over a dozen families of diptera. But much of his evidence is insecure. The paper is worthless if not interpreted by Meigen's later works, the date of publication cannot be verified, there is even doubt if the paper was distributed on the date it bears, and nowhere are any species cited, so the genera are not true binomial conceptions. This last condition alone should not be followed too closely, for many of Meigen's genera of 1803 and 1804 were likewise published without mention of species.

Naturally to exhume these forgotten names has stirred up much discussion, and in the short interim since Hendel's republishing, there have been a score of opinions given out by various biologists. These opinions are sometimes conflicting but in the main zoologists strongly decry using the law of priority to bolster up such speciesless genera as Meigen's earliest. I shall give a list of the articles that have come to my notice bearing directly or indirectly on the principle of whether or not to adopt the newly disinterred genera. In this long parley the concrete example of Meigen's paper has been lost sight of by many of the contributors, and merely the principle has been under discussion, but nevertheless the entire argument outlined below was caused by the appearance of Hendel's reprint. A short digest of the articles will help to correlate the ideas advanced.

Professor Aldrich wrote in hopes of squelching Hendel's paper, to

deter others from using the ancient names. Yet Kertész' last volume of the Catalogus Dipterorum hujusque descriptorum, volume v., 1909, adopts the family name Omphralidae for the Scenopinidae; his Catalogue of palaearctic diptera uses five of the early names in volume iii; while *Czerny* in a paper on Spanish Diptera [1] has discarded the family names Scatophagidae and Trypetidae, as he uses for them Meigen's earlier type genera *Scopeuma* and *Euribia*, forming thereby the family names Scopeumatidae and Euribiidae. However, Czerny does not use Meigen's early *Cypsela* to replace *Borborus*, as was advocated in Hendel's reprint.

Volume iii of the palaearctic catalogue has dispensed with the following well known genera on the plea of priority: *Ephippium*, *Oxycera*, *Odontomyia*, *Xylophagus*, *Haematopota*, *Subula* and *Leptis*. Surely the dipterist has a bewildering memory-lesson before him.

It is strongly to be urged in this period of nomenclatural unrest that writers be not too hasty in adopting the suggestions of Dr. Hendel. The trend of public opinion is that genera without species shall have no place in our system of classification. In view of the projected action of the Committee of the International Congress of Zoologists (see number 23 below), it would be decidedly rash to rush into publications the once-discarded names of 1800. It would be better to hold in abeyance any personal desires for Meigen's first names until the Committee can rectify the Code on this question. Such conservatism may prevent a premature overthrow of the names of our commonest genera, and might spare our overburdened literature from most confusing rearrangements of synonyms.

1. Nature, August 27, 1908, pp. 394–395.
   A composite letter by British zoologists deploring the fact that a strict adherence to rules sometimes brings unfortunate consequences.
2. N. Banks, Science, xxviii.
   Advises others who have rare papers to republish them.
3. S. W. Williston, Manual, 3rd. edit. p. 390, 1908.
   "Hendel would have deserved the thanks of a long suffering public had he withheld these copies instead of republishing."
4. M. Bezzi, Wiener entom. Zeit. xxvii. 252, Sept. 1908.
   Comments on the adoption of the names of 1800 that come in vol. iii. of Kertesz' Catalogue of palæarctic diptera, a course in which, naturally, he approves.

[1] Verh. k. k. zool.-bot. Gesellsch., Wien, vol. 59, 1909.

5. J. M. Aldrich, Canad. Ent. xl. 370–373. Oct. 1908.
Compares resurrecting the 1800 paper to finding some old grant to Indian lands. Every possible objection should be made before accepting them; a flawless case must be made out and the identification of the older genera is full of flaws. "Let justice be done" exclaims Hendel. To whom? Certainly not to Meigen by accepting this paper.
6. J. M. Aldrich, Canad. Ent. xl. 432, Nov. 1908.
Quotes from Bezzi's paper (number 4, above) in the Wiener entomologische Zeitung. Hendel (number 9, below) says that the quotation is mis-applied.
7. D. W. Coquillett, Canad. Ent. xl. 457, Dec. 1908.
Pleads for the adoption of the early names, citing rules from the code to cover his argument. Does not believe in obstructing the progress of nomenclature by discrediting Hendel's find.
8. P. H. Verrall, British Flies, v. 772, 1909.
Meigen's 1800 genera are not legally established. Does not concur with Coquillett's "aggravated" pleading (no. 7).
9. F. Hendel, Wiener entom. Zeit. xxviii. 33–36, Feb. 1909.
Discusses the comments in numbers 3, 4, 5, 6, 7, and 8. Stability of nomenclature can be had only by a strict adherence to the law of priority. Since Meigen described only genera, but gave the number of species that he knew, and in the preface designated his work as a prodromus of a later work designed to contain only the genera, he can not be said to have carelessly neglected the principles of binary nomenclature. Hendel states that 39 of the Brachycera genera can be immediately recognized from the descriptions alone. The future alone can tell whether the majority of dipterists will decide for continuity or for priority.
10. T. D. A. Cockerell, Science, xxix. 339, Feb. 26, 1909.
Calls for a postal vote of opinions about genera without species. "A genus without species has no type, no content, and apparently has no place in our systems of classification."
11. J. M. Aldrich, Canad. Ent. xli. 103, March, 1909.
In a review of Verrall's British Flies, Aldrich quotes the discovery of certain Chicago historians that the annulment of one of the marriages of King Henry VIII. was invalid, and that, consequently, King Edward VII. is not King of England. This discovery is on a par with the reasoning that Meigen's earliest genera should claim priority.
12. T. D. A. Cockerell, Science, xxix. 813, May 21, 1909.
The result of the postal vote (number 10) shows the majority of voters not in favor of resurrecting the names of speciesless genera.
13. A. A. Girault, Science, xxix. 814, May 21, 1909.
A genus described without a species is non-existent. Its name has no status until some definite type species has been designated.
14. J. A. Allen, Science, xxix. 935, June 11, 1909.
"Prior to 1810 hundreds of genera now in current use were proposed solely on the basis of a diagnosis; although they were accepted and

have been in use from the date of their proposal, many of them were without designated types for half a century." "Apparently each case should be dealt with solely on its own merits."

15. F. N. Balch, Science, xxix. 998, June 25, 1909.
In a paper, "A Lawyer on the Nomenclature Question" Mr. Balch advocates an International Court with absolute power to settle everything nomenclatorial. The priority rule was not intended to be the superstition and incubus it has become. "Questions of nomenclature are of utterly insignificant importance so only that they be settled one way or the other, quickly, definitely, and permanently."

16. F. A. Bather, Ann. Mag. Nat. Hist. (8) iv. 37–42, July, 1909.
In an article "Some Common Crinoid Names and the Fixation of Nomenclature," Dr. Bather advocates the establishment of a court of nomenclature.

17. Wm. H. Dall, Science, xxx. 149, July 30, 1909.
Most questions of nomenclature can be answered by a serious study of the Code. For the few other cases he advocates giving the Committee power of decision.

18. A. N. Caudell, Science, xxx. 210, August 13, 1909.
"How can we get a type for a genus where there were no species originally included?"

19. F. A. Bather, Science, xxx. 341, Sept. 10, 1909.
Advocates a Court for the two cases, first, where the application of the Code is obscure, and second, where its application is clear, but the consequences at the same time would be exceedingly unfortunate.

20. J. A. Allen, Science, xxx. 365, Sept. 17, 1909.
"The only point is whether they are good genera or bad genera — in other words whether they are identifiable or unidentifiable from the basis furnished by the original founder."

21. J. Dwight, Jr. Science, xxx. 526, Oct. 15, 1909.
"Zoological nomenclature to-day seems to be little more than an intricate game of names, fascinating sport for its faithful devotees, but an intolerable nuisance for the uninitiated many." "Priority is rather a bog from which the nomenclatorial muck-rakers exhume the fossil remains of a past age." "It is not justice for the dead zoologist that we need so much as justice for the living, and even now the dead get no recognition if they violate the rules of a game unknown in their day."

22. A. S. Hitchcock, Science, xxx. 597, Oct. 29, 1909.
Believes it impractical for a committee to prepare a list of names that will be stable, because of the changing state of biological knowledge.

23. J. A. Allen, Science, xxx. 596, October 29, 1909.
Proposes the following recommendation for the International Committee. "A generic name proposed without mention of any described species is invalid unless it is accompanied by a diagnosis of such a character as to indicate that it is based on a previously known species, or group of species, that can be unequivocally identified as the basis of the diagnosis."

Therefore, instead of worrying over just which of the genera can be identified, it will be vastly better for the present to ignore entirely the Nouvelle Classification. It is absurd rigidly to apply modern rules of nomenclature to the works of the early writers, when as in this instance no good can be subserved, and a most confusing and "complete revolution in dipterological nomenclature" would result, a condition that Dr. Hendel seems eagerly to have hoped for. It is commendable to make use of the law of priority when stability and permanence will be guaranteed, but in the present case it is too risky to accept Dr. Hendel's views and make the wholesale changes he has suggested. Dr. Stiles has remarked that "neither the commission nor the congress has any power to force zoologists and others to accept the International Rules." I believe that my dipterist fellow workers should feel that one such occasion confronts them, if rules are to be construed, or misconstrued, to bolster up the once-discarded names.

With this digression we may disregard the name *Coryneta*, and take up the name *Tachydromia*. As just mentioned, Meigen assigned *Musca cursitans* Fabricius and *cimicoides* Fabricius to his genus. The first of these was an erroneous determination which was afterwards named *major* by Zetterstedt. *Cimicoides* Fabricius is a synonym of *arrogans* Linneus, but Meigen was confused in his identification here too, as a part of the specimens he thought were *cimicoides* he afterward described as *connexa*. Meigen had therefore three species before him, of which two were undescribed, and the third had previously been named *arrogans* by Linneus. Obviously, according to modern rulings, the type of *Tachydromia* must be selected from these three, and as *arrogans* was the only described species among Meigen's material, that species would probably be construed as the type. But neither *arrogans* nor *connexa* has the middle femora enlarged, nor are their middle tibiae spurred. Therefore they disagree with the only salient point of the diagnosis. For that reason, according to our present ideas, neither would have been selected as the type, and the honor of serving as type of *Tachydromia* should have been bestowed on Meigen's *cursitans* (*major* Zett.). The old genus has been dismembered, the separated genera have received their types, and our present ideals have not been fulfilled, because of the everlasting blundering between personal whims and priority laws.

Article 30 of the Code states: "If the original type of a genus was not indicated, the author who first subdivides the genus may apply the

name of the original genus to such restricted genus or subgenus as may be judged advisable, and such assignment is not subject to subsequent change." Dr. Stiles [1] has given a personal ruling further that "If an author, in publishing a genus with more than one valid species, fails to designate or to indicate its type, any subsequent author may select the type, and such designation is not subject to change." Although this is a personal opinion its soundness is apparent. With these citations, we may take up the subsequent history of Meigen's *Tachydromia.*

Meigen's early conception of the genus was the same as our present idea of the subfamily Tachydromiinae, or even the combined subfamilies Tachydromiinae and Hemerodromiinae, and in this he was followed by the earlier writers, such as Fallén. In 1822 in the third volume of the Systematische Beschreibungen Meigen separated from *Tachydromia* the genera *Hemerodromia* and *Drapetis.* The remaining Tachydromias he grouped into two divisions, A and B, with his *cimicoides* in A. and his *cursitans* in B, but still retaining all in the genus *Tachydromia.* Macquart in 1827 bestowed the name *Platypalpus* on division B which was the larger group, keeping the name *Tachydromia* for the first group, but Meigen not knowing this renamed the first division *Tachypeza,* to retain the original name for the larger division. This change was published in 1830, and later he refused to adopt Macquart's name because he thought his own ideas were better.

In a paper in the Zeitschrift fuer Entomologie, published in Breslau in 1863 Loew discussed the question at length and following Meigen discarded the name *Platypalpus* because it is a poorly formed compound of Greek and Latin. For the larger group, or those species related to *cursitans,* he retained the name *Tachydromia.* The remainder of the genus he subdivided into *Tachypeza, Tachista, Dysaletria,* and *Phoneutisca,* bestowing the name *Tachista* on those species grouped about *cimicoides.* The majority of the prominent European dipterists have adopted this view principally out of deference to Meigen and Loew.

The date of publication of the name *Platypalpus* is certain, and its designation is unquestionable. We have therefore no recourse but to accept it as a valid name. To this genus belongs the *cursitans* of Meigen's original *Tachydromia.* Eliminating this species, the *cimi-*

[1] Bull. 24, Hygienic Laboratory, p. 27 (1905) Rule 10.

coides of Meigen should be the type of the restricted *Tachydromia*. Coquillett however has designated *connexa* as the type, forgetting that part of Meigen's *cimicoides* belonged to Linnaeus' early species *arrogans*. This however will not invalidate the limitations of the restricted Tachydromia, as *arrogans* and *connexa* are very closely related species, certainly congeneric.

The status of the old genus *Tachydromia* is therefore as follows.

Front and middle femora thickened: *Division B.* Meigen.
Platypalpus Macquart, Westwood, Blanchard, Walker, Schiner, Philippi, Coquillett, Melander.
Tachydromia Meigen, Burmeister, Zetterstedt, Berendt, Scholtz, Bonsdorff, Loew, Bigot, Mik, Strobl, Becker, Kertész, Bezzi, Frey.
Phoroxypha Rondani, Coquillett.
Front femora thickened: *Division A.* Meigen.
Anal cell imperfect..... **Tachypeza** Meigen, Loew.
Anal cell completely wanting..... **Tachydromia** Meigen, Coquillett.
Tachista Loew, Becker.

The type species of these genera are as follows:

Platypalpus. Type species *cursitans* Fabricius, indicated by Westwood in 1840. It is quite likely that Westwood had Meigen's original *cursitans* in view, in which case the type should be *major* Zetterstedt.

Tachypeza. Type species *nubila* Meigen. Rondani in 1856 designated *nervosa* Meigen as the type, and this is a synonym of *nubila*.

Tachydromia. Type species *connexa* Meigen. As explained before Meigen indicated two species, *cursitans* and *cimicoides*. As the type species should be one of those originally listed by the describer elimination leaves *cimicoides* as the type, since Meigen's *cursitans* belongs to the subsequently erected genus *Platypalpus*. Meigen's *cimicoides* included two species, *arrogans* Linnaeus and the later described *connexa* Meigen, the second of which Mr. Coquillett has designated as the type.

During the last half century a number of other genera have been proposed for new material rather than as constrictions of the older genus. The relationships of these genera can be seen from the following synopsis of the present subfamily Tachydromiinae. All the known genera and sub-genera are included.

Genera and Subgenera of the Tachydromiinæ.

Thorax slender, humeri large, strongly constricted: palpi narrow: legs not bristly: front femora thickest.
First basal cell much shorter than the second: black species.
Anal cell present: arista terminal.....**Tachypeza** Meigen.
Anal cell completely wanting.
Arista terminal or sub-terminal: marginal cell long.
Tachydromia Meigen.
Arista sub-dorsal: second vein abruptly recurved.
Phoneutisca Loew.
First basal cell longer than second; outer angle only of anal cell present: yellow species.....**Dysaletria** Loew.
Thorax broad: humeri rarely large: legs hairy and usually with bristles: palpi usually broad.
First basal cell shorter than second: eyes close together, especially below the antennae.
Arista terminal.
Anal cell complete or incompletely formed.
Front and middle femora thickened: middle femora with a double row of spines beneath: middle tibiae ending in a spur: eyes separated: palpi broad.....**Platypalpus** Macquart.
Last joint of tarsi normal.....**Platypalpus** s. str.
Last joint of anterior tarsi greatly lengthened.
Cleptodromia Corti.
Femora not thickened: middle legs without spurs and with minute or no spines: eyes contiguous: palpi small: basal cells subequal.
Symballophthalmus Becker.
Anal cell wholly wanting: posterior femora more or less thickened.
Drapetis Meigen.
Body robust, abdomen shorter than thorax: Wings broad, not ciliate.
Third antennal joint short-oval.....**Drapetis** s. str.
Third antennal joint lanceolate.....**Elaphropeza** Macquart.
Body more slender: abdomen longer than thorax: wings cuneiform: costa long ciliate.....**Ctenodrapetis** Bezzi.
Arista dorsal: front femora thickened.....**Stilpon** Loew.
First basal cell equal to or longer than second: more or less opaque pollinose species: eyes usually widely separated on the face.
Arista dorsal.
Wings less than one-third the abdomen.....**Thinodromia** Melander.
Wings surpassing the abdomen, anal cell faint...**Halsanalotes** Becker.
Arista terminal.
Antennae three-jointed: legs thick and bristly: eyes very small.
Coloboneura Melander.
Antennae two-jointed: legs but little thickened and with few bristles, face narrow.....**Chersodromia** Walker.

Tachydromia sens. str.

Minute, slender flies of shining jet-black color and almost devoid of hairs and bristles. Head globular, eyes large, with large facets, in both sexes broadly contiguous on the face; front narrow, its sides nearly parallel, and but slightly diverging toward the vertex; three ocelli present; occiput broad, produced sub-conically at the neck and provided with sparse short bristles. Antennae short, two-jointed, the outer joint short rounded oval, with the long slender nearly bare arista terminal or nearly so. Proboscis shorter than the head, rigid, vertical: palpi applied against the proboscis and tipped with several short bristles.

Thorax longer than broad, not greatly convex, not truncate in front but considerably narrowed from the wings forward; humeri remarkably enlarged and separated from the narrow central part of the mesonotum by more or less deep furrows; a prealar lateral bristle on mesonotum; scutellum normally with two pairs of short marginal bristles, the basal pair microscopic, usually no other thoracic bristles or hairs present. Hypopygium small, more or less globular, or triangular in outline, terminal. Legs slender, the front femora somewhat thickened, devoid of bristles, but with microscopic hairs, those of the under side of the front tibiae serrately arranged, no spurs or conspicuous spines present. Sometimes the male legs have small spines on the middle femora or tibiae beneath. Wings narrow, costa ending at the fourth vein and sometimes thickened beyond the insertion of the first vein, hind margin of the wing short ciliate; no trace of an anal cell present.

Our known American species of *Tachydromia* divide nicely into two groups. The first of these includes slender species with elongate wings and legs. This group is typical of *Tachydromia* and is largely represented in the palaearctic fauna. The second group is more aberrant. Our species will probably be separated ultimately from *Tachydromia* as several genera, but for the present it would be quite unwise to do so. It is unfortunate that the small size and difficulty of capture of these species are responsible for their scarcity in collections. Undoubtedly we know but a fraction of the forms the world over, and until our collections are more complete we cannot hope to understand the relationships of these interesting little flies.

The typical Tachydromias are shining black, nearly bristleless flies and have a dark band, or two dark bands, across the wings. The

arista is terminal and the palpi are long and narrow. The front of the head is very narrow, its sides almost parallel. The emargination of the eyes at the level of the antennae is less deep, and all the facets are of nearly uniform size. The pectus is pruinose, the coating extending backwards to form a conspicuous glistening white spot over the front coxae and under the humeri. The hypopygium is also somewhat smaller than with the other members of the genus. The first basal cell is generally very long. It is to this group that *arrogans* and *connexa* belong.

The species of the second group differ in having a shorter and broader thorax, with the humeri not so pronounced. They lack the pruinosity above the front coxae. The arista is subterminal and the palpi are usually broader. The front of the head is broader, with its sides diverging above. The eyes are more deeply emarginate, and the lower facets are conspicuously larger than the upper. The wings are shorter in proportion to the body, and are not fasciate; the two basal cells are more nearly equal in size, and the marginal cell is usually shorter.

Although the genus separates into two definite groups whose characters may seem to be of generic value, I hesitate about placing together the species of group two as a restricted genus, for they appear to represent several phyletic lines. The basic points of difference between these species are the following:

1. *simplicior.* Wings as in *Drapetis*: palpi narrow: thorax glistening, devoid of bristles: humeri prominent.
2. *maculipennis, calva.* Palpi narrow: thorax narrow, glistening black, devoid of bristles, humeri prominent.
3. *insularis.* Thorax shorter, somewhat glaucous, humeri smaller: palpi long and narrow.
4. *agens, universalis.* Thorax somewhat glaucous, shorter, with bristles; humeri smaller: palpi broader.

The table following is given for the determination of the American species. Several other species have been referred to this genus by one writer or another. The accompanying notes will explain their status.

Tachydromia lata Coquillett [1] is omitted from the tables as it probably is a *Drapetis*. Since the description states that the mesonotum is broader than long, the legs are provided with bristles and the first

[1] Proc. Ent. Soc. Wash. V. p. 266 (1903).

basal cell is much shorter than the second it is evident that the species is not a *Tachydromia*. Mr. Coquillett separates *Tachista* (or *Tachydromia* as here given) from *Drapetis* in his analytic key only by the comparative thickness of the front femora, an elusive characteristic.

Tachydromia nubifera Coquillett [1] has been referred by its author [2] to the genus *Coloboneura*, a genus which has very bristly legs. I am unable to corroborate this from his description alone. The shortened second basal cell of *nubifera* excludes the species from *Tachydromia*, but the subopaque pruinosity and colored wings are at variance with the typical species of *Coloboneura*.

Mr. Coquillett has assigned *Drapetis flavida* Williston to *Tachista* [3] While the male is unusually slender for a typical *Drapetis* this species lacks the constricted swollen humeri of the *Tachydromia* group and moreover the legs are pubescent and provided with bristles and both the marginal and the first basal cells are short as in *Drapetis*. The species can with all propriety be located in Bezzi's recent subgenus *Ctenodropetis*. It may be here noted that the description of *Tachydromia bacis* Walker described from Jamaica tallies with this species. As Mr. Walker's description is unusually complete, mentioning even the bristles of the legs, it is reasonably certain that both species are the same. I have specimens from Yucatan, Orizaba, Vera Cruz, Cuba and Hayti. Mr. Coquillett reports it from Porto Rico, and Dr. Williston's specimens came from St. Vincent. It is evidently a common species within its geographic range. There is an ancient and brief description of *Tachydromia abdominalis* Wiedemann [4] from China that also applies to our specimens. *Ctenodrapetis ciliatocosta* Bezzi [5] from Australia is also quite similar, but is somewhat smaller. Possibly there is but one widely distributed form. I take it that *abdominalis* is a *Ctenodrapetis* rather than a *Platypalpus* as the abdomen is described as lusterless. In almost all the species of *Platypalpus* the abdomen is shining.

Mr. Coquillett [6] thinks that *Phoneutisca bimaculata* Loew is a synonym of *maculipennis* Walker which was described from Hudson

[1] Dipt. Commander Isl. p. 343 (1898).
[2] Proc. Ent. Soc. Wash V. p. 265 (1903).
[3] Proc. U. S. Nat. Mus. XXII. p. 251 (1900).
Proc. Ent. Soc. Wash. V. p. 265, note. (1903.)
[4] Auss. zweifl. Ins. II. 12 (1829).
[5] Ann. Mus. Nat. Hung. II. p. 355 (1904).
[6] Proc. Ent. Soc. Wash. V. p. 266 (1903).

Bay Territory. I do not think this is so. *Bimaculata* is a much smaller species with white palpi, and is rare. The only specimen I have seen is the type from Alaska. I take it however that *maculipennis* is the same as our common *pusilla* Loew. I have examined over fifty specimens of this species from Massachusetts, Wisconsin, Illinois, Missouri, and South Dakota. Since it is so widely distributed in the States it probably occurs in Canada also. The rest of Mr. Walker's Tachydromias I can not decipher. They may belong to *Tachypeza* or to the present genus. Osten Sacken listed *vicarius* as a *Platypalpus*. The two-line description reads that the legs are slender which raises more doubt as to what the species really is.

Table of the North American Species of Tachydromia.

1. A white glistening pruinose spot between the front coxae and the humeri, rarely absent: wings with two dark bands: the distance between the two cross veins more than twice the length of the hind cross vein: arista terminal.....2.
   No glistening spot on the pleurae: wings with a single brownish subapical cloud or hyaline; cross veins separated scarcely more than the length of the hind cross vein: arista subterminal.....6.
2. Palpi and halteres black: marginal cell obliquely truncate **enecator** Melander.
   Palpi and halteres paler: marginal cell rounded at the end.....3.
3. Dark cross bands united along the costa.....**varipennis** Coquillett.
   Dark cross bands separated.....4.
4. Wings blunt, fringed with comparatively long hairs: propleurae not pruinose.....**ciliata** sp. nov.
   Wings slender, the marginal hairs short: propleurae pruinose.....5.
5. Legs nearly uniformly dusky.....**schwarzii** Coquillett.
   Base of legs pale yellow, outer portions in part black. **schwarzii** var. **diversipes**. var. nov.
6. Palpi black: wings with a broad subapical cloud. **maculipennis** Walker.
   Palpi yellowish: wings unclouded.....7.
7. Thorax shining, humeri prominent: palpi narrow.....8.
   Thorax and abdomen sub-glaucous, humeri smaller.....9.
8. Third and fourth veins divergent.....**simplicior** Wheeler & Melander.
   Third and fourth veins subparallel.....**calva** sp. nov.
9. Palpi long and narrow: scutellum with four bristles: antennae reddish **insularis** sp. nov.
   Palpi broader: scutellum with two bristles.....10.
10. Acrostichal and dorsocentral bristles present: legs slender piceous, antennae black.....**agens** sp. nov.
    Middle of dorsum without bristles: base of legs and of antennae yellow, last tarsal joint black.....**universalis** sp. nov.

Tachydromia enecator Melander.

Trans. Am. Ent. Soc., xxviii, 226, ♀ (1902).

Length 3¼ mm. Totally jet black, shining, except that the knees narrowly and the metatarsi are piceous, the palpi, antennae and halteres are dull black, and the hinder occiput, pectus, metanotum, a narrow vertical stripe on the metapleurae, front coxae, and underside of the front femora are provided with a light pruinose coating. Outer antennal joint elliptical, arista terminal. Humeral swellings of mesonotum large and well marked: no bristles on disc of mesonotum, scutellum with four minute bristles. The ♂ abdomen depressed, less shining apically, the hypopygium small, terminal, somewhat triangular in outline, it and the last ventral segment provided with short blackish hairs. Wings with two dark cross bands, the second vein appendiculate in the known specimens.

But five specimens are known of this species. The two cotypes, both females, are from Quebec and Wyoming. They are now located in the Wheeler collection at the American Museum of Natural History, New York City. I have a male and two females, collected by my former student, E. L. Jenne, at Douglas, Alaska, August 2, 1901. This is our largest species.

Tachydromia schwarzii Coquillett.

Coquillett, Proc. U. S. N. Mus. xviii. 440 (1895).
Melander, Trans. Am. Ent. Soc. xxviii. 225, fig. 52 (1902).

Length 2.5 mm. Shining black, the legs yellowish. Occiput and propleurae pruinose. Antennae fuscous to black, the outer joint rounded, the terminal arista about four times the length of the antenna. Facets of the eyes nearly uniform, front narrow. Palpi glistening white to dirty white, elongate and slender. Mesonotal disc shining, bristleless, scutellum with four short bristles. Hypopygium moderate, rounded, its curved slender appendages sometimes exserted. Legs including the coxae dusky yellow, the hind legs darkest, the tibiae and tarsi more or less infuscated. Halteres pale yellow. Wings slender, rather pointed, crossed by two broad brownish fasciae, leaving the base, middle and tip hyaline; the marginal cilia normally short.

This is a common insect in the West. During the entire summer it hurries about in quick little zig-zag runs in search of its small victims, curiously probing among grass, stones, sidewalks, houses, in fact it can be found almost everywhere in this region. I have seen hundreds of living specimens, and have examined nearly a hundred mounted individuals from Moscow, Idaho, and Pullman and Wenatchee, Washington. The types came from California and Utah. They are numbered 3246 and 3247 in the National Museum collection.

In structure, venation, and general appearance this species resembles *annulimana* Meigen, of the European fauna; which however has striped femora, incrassate front tibiae, an erect hypopygium, some dorsocentral bristles in front of the scutellum, and moreover lacks the white pruinose spots beneath the humeri.

Tachydromia schwarzii var. **diversipes** var. nov.

Melander, Trans. Am. Ent. Soc. xxviii. 225 (1902). *T. schwarzii*, var.

Male. Similar to *schwarzii* in all structural characters, but differing in coloration. The base of the legs is lighter, the outer portions blacker than in typical form, thus making a greater contrast in color. The coxae, trochanters, base of all the femora, the basal two-thirds of the front tibiae, and the tarsi except the tip almost white in color. The outer third of the front tibiae is abruptly black; the four posterior tibiae, except the knees, and the hind femora except the base, black. The palpi are blackish. The cross-bands of the wings are lead-gray, and are darker than is usually the case with *schwarzii*, where they generally have a brownish tinge.

Two males which I captured at Dry Creek, near Austin, Texas, April 20, 1901. The specimens were running over rather large stones in this moist ravine at the base of Mount Barker.

Tachydromia ciliata sp. nov.

Wheeler and Melander, Biologia Cent. Am., Dipt. Suppl. 375 (1901) *schwarzii*.

Female. Length about 2 mm. Quite similar to *schwarzii* in general appearance, but differing in the structure of the wings. Shining black, legs clear yellow except the infuscated outer two-thirds of the hind femora and tibiae. Antennae yellow; as they are defective nothing can be stated about the arista. Front narrow, facets of the eyes uniform. Palpi whitish. Occiput and thorax shining black, the propleurae not pruinose: humeri large and deeply constricted: the inner pair of scutellar bristles moderately long. First ventral segment white or whitish. Halteres yellow. Wings comparatively short and broad, blunt at the end, and margined with a conspicuous fringe of hairs which are prominent even on the costa; two brown cross-bands are present as in *schwarzii*, but because of the shortened wings the outer fascia appears less extensive; the third and fourth veins more distant from each other and continuing to the wing-tip without converging (in *schwarzii* they lie closer together and converge towards the tip).

I have two specimens before me from Guerrero, Mexico, one taken at Chilpancingo, at 4600 feet altitude, the other labeled Sierra de las Aguas Escondidas, 9500 feet. There are some minor differences between the two specimens. The former measures 1.75 mm. and has

the outer cross-band nearly as in typical *schwarzii*. The latter individual measures fully two mm. The base of its wings is less hyaline, but otherwise the wings are as described. The first ventral segment of the abdomen is only dusky, not white. The third specimen mentioned in the Biologia is in the Wheeler collection at the American Museum. This species corresponds to *excisa* Loew of the European fauna.

Tachydromia varipennis Coquillett.

Coquillett, Proc. Ent. Soc. Wash., v. 266 (1903).
Slosson, Ent. News, xiv. 266 (1903) habits.

Length 2 mm. Shining black, pro- and metapleurae pruinose, coxae, base of femora and proximal part of tarsi fuscous. Outer antennal joint short ovate, the terminal arista three times the length of the antenna. Palpi whitish. Humeri constricted from the central part of the thorax by an evident groove; no bristles on disc of notum, scutellar bristles minute. Hypopygium minute, terminal, without conspicuous hairs. Halteres white. Wings infumated, the base, tip and a transverse streak in the middle, but not including the marginal and submarginal cells hyaline.

I have four specimens from the type lot, received from Mrs. Annie Trumbull Slosson. They were taken in the White Mountains at Franconia, New Hampshire. The type is in the National Museum, number 6774. It is this species that is mentioned in Aldrich's Catalogue, page 314 under *schwarzii*, as occurring in New Hampshire.

In her article, Hunting Empids, in the October issue of the Entomological News for 1903, Mrs. Slosson gives the following notes on the habits of this fly. "About the first of July I always find here a pretty little creature running rapidly over wet stones at the margin of streams. It is a tiny fly with gray wings variegated with black, and its habits are odd and interesting. Though its wings are fully formed and quite capable of flight, it very rarely uses them. When pursued by the collector it runs swiftly like an ant on and around the stone, and will continue this elusive performance for many minutes, though by spreading its pretty wings it could at once escape capture. Only in desperate extremity, as a very last resort, will it sometimes take flight and rest upon another near-by stone. For a long time I found them very difficult to catch. But at last I discovered that by seizing the stone on which one was running and dropping it quickly into my net I had the little fellow safe and sound."

Tachydromia maculipennis Walker.

Walker, List Dipt. Ins. in Coll. Brit. Mus., iii. 507 (1849).
Loew, Cent. v., 74 (1863) *Tachypeza pusilla* ♀.
Melander, Trans. Am. Ent. Soc. xxviii. 228; and 229, f. 51 (*pusilla*); and 204, f. 1. (*Phoneutisca bimaculata*, Dakota specimens) (1902).
Coquillett, Proc. Ent. Soc. Wash. v. 266 (1903) *Phon. bimaculata.*
Aldrich, Catalog N. Am. Dipt., 310 (1905), *Phon. bimaculata.*

Length 2 mm. Shining black, antennae, palpi, proboscis and halteres also black, no pruinose spots on thorax. Outer joint of antennae short-conical, the arista two times the length of the antenna, almost terminal. Humeral swellings prominent, well constricted from the central portion of the thorax; no notal bristles; scutellum with four marginal bristles, the outer pair short. Hypopygium swollen, black hairy, the last ventral segment with a conspicuous fringe of black bristles. Legs largely blackish, the coxae, trochanters, and base of the femora paler; front tibiae and tarsi more or less yellowish; the last two tarsal joints black. Halteres whitish. Wings with a brownish cloud filling the submarginal and first posterior cells; the two cross veins approximate.

The type of this species, now in the Museum of Comparative Zoology, Cambridge, Massachusetts, was collected by LeBaron in Illinois. I have specimens before me from Chicago, Illinois, Milwaukee, Wisconsin, Atherton, Missouri (C. F. Adams) and Brookings, South Dakota (J. M. Aldrich). Dr. Hough has taken the species at New Bedford, Massachusetts. Mr. C. W. Johnson records *pusilla* from New Jersey in Smith's Catalog. The synonymy of this species is discussed in the introduction *anteà*, page 52.

Tachydromia simplicior Wheeler and Melander.

Wh. and Mel., Biologia Cent. Am., Dipt. Suppl. 375 (1901) *Phoneutisca.*
Melander, Trans. Am. Ent. Soc. xxviii. 205, f. 6. (1902) *Phoneutisca.*

Length 1.5 mm. Body shining black, legs entirely yellow. Antennae short, the outer joint minute, smaller than the basal joint, the arista sub-dorsal. Palpi pure white, moderately broad. No bristles on mesonotal disc; scutellum with a pair of well separated marginal bristles; humeri well constricted and prominent; the sides of the thorax are very lightly pruinose, but there is no pruinose spot above the front coxae. Abdomen depressed, brownish hairy, the hypopygium small, terminal. Legs including the coxae yellow, the hind femora a little infuscated apically. Halteres yellow. Wings nearly hyaline, a very faint darker streak passes longitudinally through the middle of the wing; marginal cell short, submarginal cell full, third and fourth veins divergent.

A single male collected by Mr. H. H. Smith at Vera Cruz, January, 1888, from the Wheeler collection of the American Museum of Natural History. This specimen very likely belongs with the type female, which was collected in Chilpancingo in Guerrero. The two locations are on opposite sides of Mexico. The specimen is glued on a card and is not in the best of condition for description. The type has the third vein nearly straight. Here it is rounded in an even curve diverging from the fourth. This specimen has less of the purplish and bronze tinge to the body.

The definition characters of *Phoneutisca* led us to place this species in that genus. An examination of the true *Phoneutisca bimaculata* in the Museum of Comparative Zoology showed it to be quite a different insect than was supposed. The abruptness of the marginal cell in *Phoneutisca* is very striking.

Tachydromia calva sp. nov.

Shining black above, paler beneath, outer half of femora blackish. Antennae black, palpi slender, whitish, dorsum without evident bristles; wings lightly infumated, third and fourth veins sub-parallel.

Female. Front jet black, triangular; ocelli prominent, occiput with sparse short black hairs; eyes deeply and broadly emarginate at antennae, face obliterated by the contiguity of the eyes, facets nearly uniform. Antennae short black, last joint not as long as broad and smaller than basal joint, the arista subterminal, finely and closely pubescent, nearly five times the length of the antenna. Palpi narrowly elongate, whitish yellow: proboscis very small, black.

Thorax shining black, the humeri large, so that the thorax is nearly quadrate, a few microscopic dorsal bristles only, a single bristle in front of the wings, scutellum with a pair of short bristles, the scutellum very lightly dusted. Abdomen pitchy black, sub-shining. Coxae, trochanters, basal half of femora and the tibiae yellow, outer half of femora blackened, tarsi a little dusky; front femora somewhat thickened. Halteres yellow. Wings narrow, nearly hyaline, lightly infumated especially noticeable at tip of first vein, marginal cell long, third and fourth veins parallel.

Described from a single female, presumably collected by Mr. G. R. Pilate as it bears the label, Tifton, Georgia, Sept. 25, 1896. The specimen was presented to me by Dr. G. deN. Hough. It measures one millimeter in length.

Tachydromia insularis sp. nov.

Male. Length 1.1 mm. Head and thorax pruinose; legs testaceous; wings clear hyaline; antennae reddish at base; palpi elongate, reddish;

scutellum with four black bristles; acrostichal and dorsocentral bristles microscopic; hypopygium large, flexed to the right.

Front narrowly V-shaped, cinereous; ocelli large, ocellar bristles present, black; first antennal joint testaceous, the outer joint fuscous, pubescent, arista subterminal, pubescent, four times the length of the antenna. Eyes completely contiguous on the face, facets uniform. Palpi twice as long as broad, sericeous, testaceous. Proboscis slender, vertical, piceous, one-half the height of the head. Occiput and entire thorax rather lightly covered with cinereous pollen; humeri comparatively small and not so deeply constricted as in the other species; the usual black bristles present along the sides of the notum; scutellum with two long decussating and two short bristles; acrostichal and dorsocentral rows of minute whitish bristles present, with about six bristles to each row, the last dorsocentral large; no pleural hairs. Abdomen brown-black, sub-shining, last segments black hairy; hypopygium large, globular, flexed to the right. Coxae shining yellowish, legs yellowish, femora dusky on the outer half, legs provided with short white bristly hairs, middle tibiae with series of minute black setulae beneath, front femora much thicker than the others. Halteres dusky. Wings clear hyaline, veins strong, hind margin ciliate; first posterior cell ending at wing tip, and there somewhat contracted, marginal cell a little longer than the submarginal along the costa.

Described from a single specimen labeled, Grenada, W. I., received from Prof. J. M. Aldrich.

Tachydromia agens sp. nov.

Male and female. Length 1.3 mm. Head and thorax pruinose, legs dark fuscous, wings clear hyaline; antennae blackish; palpi sub-quadrate, pale; acrostichal and dorsocentral bristles conspicuous, scutellum with four white bristles; hypopygium terminal.

Front broad above, narrow and sub-parallel below, cinereous; ocelli small, ocellar bristles small; occiput lightly pollinose, its cilia white and conspicuous; antennae small, black, the basal joint blackish, arista almost terminal, short, although four times the length of the antenna, microscopically pubescent. Eyes completely contiguous on the face, deeply but narrowly excised at the antennae, facets nearly uniform, those below larger. Palpi of male yellowish, one-half longer than broad, with three long terminal white hairs, in the female the palpi are dusky but with a white sheen. Proboscis black, no longer than the palpi, projecting somewhat forward.

Thorax cinereous pollinose, humeri round, not quite as broad as the interhumeral space, the furrow not deep except behind; all the thoracic bristles white, the acrostichal and dorsocentral rows well developed, the lateral bristles comparatively short, about a dozen in front of the wings: scutellum with two long and two short white bristles; no pleural bristles. Abdomen sub-shining olivaceous black, with sparse stubby whitish hairs, the lateral margins of the intermediate segments with the round black pits characteristic of *Coloboneura*, *Parathalassius*, etc. Hypopygium closed, terminal, elongate. Coxae shining,

posterior ones piceous, front coxae fuscous and with white hairs; legs dark fuscous, with whitish pubescence, middle tibiae setulose beneath, front femora somewhat the thickest, reddish beneath. Halteres yellowish; tegulae with a few white cilia. Wings clear hyaline, veins strong, hind margin short ciliate, marginal cell long, third and fourth veins parallel.

Type male collected on a windowpane July 3, 1906, in my house at Pullman, Washington. Type female taken in a wheat field nine miles west of Baird, Washington, June 23, 1908. This species was noticed actively running about the ground and stalks in wheat fields in several places in Central Washington. I have also five mounted paratypes which I collected at Lynden, Baird, and Pullman, all in Washington State.

Tachydromia universalis sp. nov.

Black, sparsely and lightly dusted; wings nearly uniformly hyaline; arista subterminal, the basal antennal joint red; palpi broad, white; legs reddish, variegated with brown; halteres yellow.

Male and female. Length 1.75 mm. Black, shining, lightly dusted with a gray pruinosity, which is more conspicuous on the pleurae, propleurae not glistening white. Antennae short, the two joints about equal in length, the basal joint red, the outer joint blackened, rounded oval, with a subterminal arista which is two and one-half times the length of the antenna. Front broad, its sides diverging above, the ocelli widely spaced. Upper facets minute, the lower ones larger. Palpi conspicuous, pendant, broad, white, with white hairs: proboscis black in the male, blackish in the females. Thorax comparatively broad, the humeri rather large but not long, the grooves rather distinct; acrostichals wanting, only a couple of weak dorsocentrals present near the scutellum; scutellum pruinose, and with two short bristles. Abdomen depressed, shining jet black, but overlaid with a light coating of gray dust: hypopygium large, shining, provided with a stout curved end-process which projects to the right; sides of the abdominal segments with minute muscle-attachment pits, as in *agens*. Legs reddish yellow, the upper side of the hind femora, the ends of the tibiae and the last tarsal joint darker; front femora thickened, hind femora scarcely reaching the last third of the abdomen. Halteres yellow. Wings rather broad, hyaline, but with a faint smokiness following the veins; veins strong, dark, but becoming yellowish at the base of the wing; marginal cilia minute; hind cross vein making an acute angle at the lower corner of the second basal cell.

Described from five specimens collected in the following widely separated localities: Chester County, Pennsylvania, June, 1902 (J. C. Bradley), Algonquin, Illinois, July 17, 1896 (Dr. Wm. Nason), and Austin, Texas.

This species is related to *agens* as is evident from the shortened broad thorax with the humeri less pronounced than in typical Tachydromias, the broad palpi, the widened front, subterminal arista, and pruinosity of the body. However it is readily distinguishable by the paler color of the legs, antennae, halteres and root of wing.

Catalogue of the Described Species of Tachydromia.[1]

1. *aemula* Loew, Zeitschr. Entom. Bresl. XVII. 22 (1863).....Eur. C.
*2. *agens* sp. nov.....Wash.
3. *aliterpicta* Becker, Act. Soc. Fenn. XXVI. 32 (1900).....Eur. S. C.
alteropicta Becker, Berl. Ent. Ztschr. XXXIII. 343. (1899).
*4. *annulimana* Meigen, Syst. Bes. III. 69 (1822).....Eur.
albitarsis Zetterstedt, Dipt. Sc. 1. 313 (1842).
arrogans Linnaeus, Zetterstedt, Ins. Lapp. 546. var. d. (1838).
cimicoides Fabricius, Walker, Ins. Brit. I. 140 (1851).
umbrarum Haliday, Ent. Mag. I. 161 (1833).
*5. *arrogans* Linnaeus, Fauna Suec. 1857 (1761).....Eur.
bifasciata Rossi, Fauna Etr. Mant. II. 77 (1794).
cimicoides Fabricius, Spec. Ins. II. 447 (1781).
6. *brevipennis* v. Roser, Wuerttemb. Corresp. 1. 53 (1840).....Eur. C.
? *microptera* Loew, Ztschr. Ent. Bresl. XVII. 26 (1863).
*7. *calcanea* Meigen, Syst. Bes. VII. 95 (1838).....Eur. C.
longipennis Loew, Ztschr. Ent. Bresl. XVII. 29 (1863).
*8. *calva* sp. nov.....Georgia.
9. *catalonica* Strobl, Mem. R. Soc. Esp. III. 319 (1906).....Eur. S.
var. *striatipennis*, Strobl. l. c. 320.
*10. *ciliata* sp. nov.....Mex.
*11. *connexa* Meigen, Syst. Bes. III. 70 (1838).....Eur.
cimicoides Fabricius, Meigen, p. p. Klass. I. 239 (1804).
morio Zetterstedt, Ins. Lapp. 546 (1838).
12. *dichroa* Bezzi, Jenaische Denkschr. XIII. 183 (1908).....Afr. S.
*13. *enecator* Melander, Trans. Am. Ent. Soc. XXVIII. 226 (1902)
Alask., Wyom., Quebec.
14. *excisa* Loew, Zeitschr. Ent. Bresl. XVII. 27 (1863).....Eur. C.
15. *incompleta* Becker, Act. Soc. Fenn. XXVI. 33 (1901).....Siberia.
*16. *insularis* sp. nov.....Grenada.
*17. *interrupta* Loew, Zeits. Ent. Bresl. XVII. 19 (1863).....Eur. S.
*18. *maculipennis* Walker, List. Dipt. Ins. III. 507 (1849) N. Am.
pusilla Loew, Cent. V. 74 (1864).
bimaculata Loew, Melander, Trans. Am. Ent. Soc. XXVIII. 204.
19. *minima* Becker, Act. Soc. Fenn. XXVI. 32 (1901).....Siberia.
20. *monserratensis* Strobl, Mem. Soc. Esp. III. 318 (1906).....Eur. S.
21. ? *morio* (Zetterstedt) Walker, Ins. Brit. I. 141 (1851).....England.

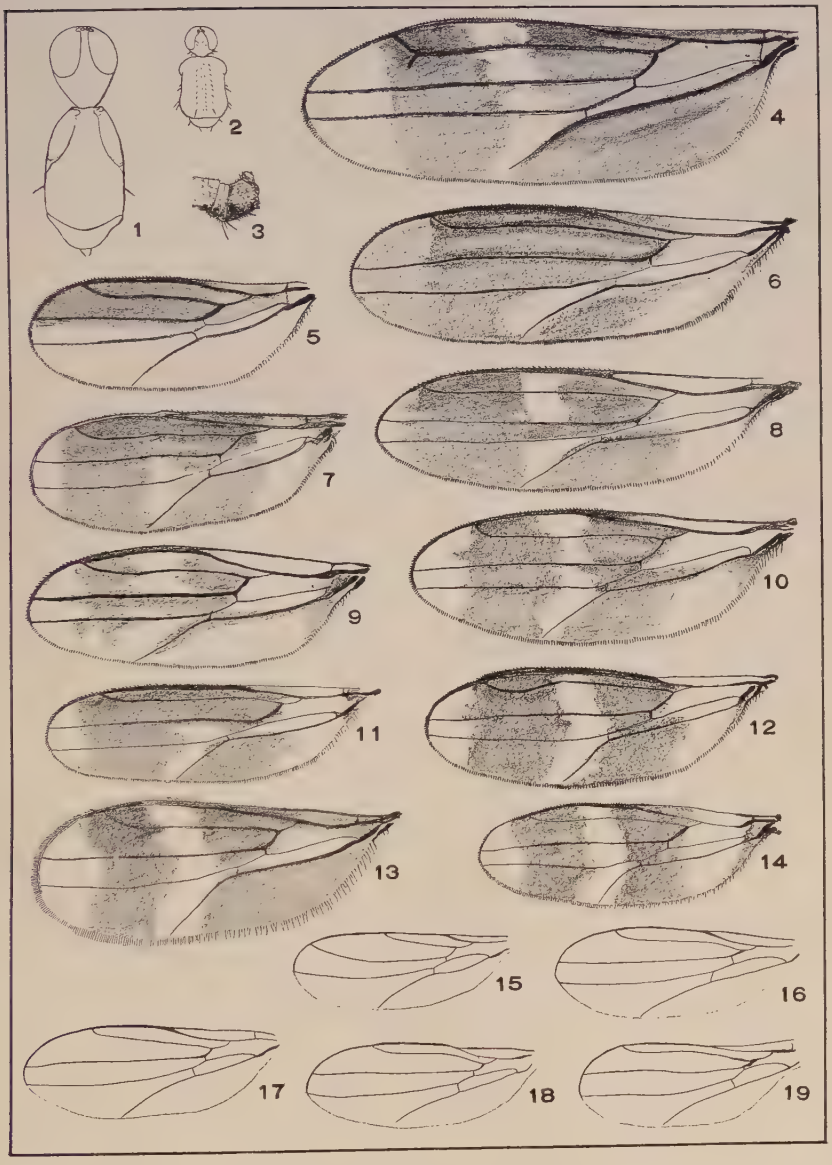
[1] Those species figured on the plate are marked with an asterisk.

22. *ornatipes* Becker, Wien. Ent. Ztg. IV. 69 (1890).....Tyrol.
23. *punctifera* Becker, Act. Soc. Fenn. XXVI. 32 (1901).....Siberia.
24. *sabulosa* Meigen, Syst. Bes. VI. 342 (1830).....Eur. N. C.
fenestrata Zetterstedt, Dipt. Sc. I. 318 (1842).
*25. *schwarzii* Coquillett, Proc. U. S. N. M. XVIII. 440 (1895). N. Am. W.
var. *diversipes*, var. nov.....Tex.
*26. *simplicior* Wheeler and Melander, Biologia C. Am. Dipt. I. 375 (1901). Mexico
*27. *styriaca* Strobl, Mitth. Ver. Steierm. XXIX. 124 (1893).....Alps.
var. *semifasciata* Strobl, l. c. 125.
28. *terricola* Zetterstedt, Kon. Vet. Ak. Handl. 81 (1819).....Eur. N. C.
29. *tuberculata* Loew, Zeitschr. Ent. Bresl. XVII. 19 (1863).....Eur. C.
30. *undulata* Strobl, Mem. Soc. Esp. III. 317. (1906).....Eur. S. E.
*31. *universalis* sp. nov.....U. S.
*32. *varipennis* Coquillett, Proc. Ent. Soc. Wash. V. 266 (1903).....N. H.
33. *vitripennis* Bezzi, Jenaische Denkschr. XIII. 182 (1908).....Afr. S.

Explanation of Plate 3.

The figures are drawn to practically the same scale of magnification, the camera lucida being used. The enlargement is about twenty diameters. As but four of the exotic species (*connexa* Meig., *incompleta* Beck., *ornatipes* Beck., and *punctifera* Beck.) have been figured, I have included drawings of the wings of those European species I possess.

Fig. 1. *Tachydromia enecator* Mel. Dorsal aspect of head and thorax.
" 2. " *agens*, n. sp. " " " " " "
" 3. " *maculipennis* Walker. Lateral aspect of hypopygium.
" 4. " *enecator* Mel. Wing.
" 5. " *maculipennis* Walk. Wing.
" 6. " *calcanea* Meig. Determination by Strobl. Europe.
" 7. " *connexa* Meig. Determination by Strobl. Europe.
" 8. " *styriaca* Strobl. Determination by Strobl. Europe.
" 9. " *interrupta* Loew. Determination by Strobl. Europe.
" 10. " *arrogans* Linn. Determination by Kertesz. Europe.
" 11. " *varipennis* Coq.
" 12. " *annulimana* Meig. Determination by Bezzi. Europe
" 13. " *ciliata* n. sp.
" 14. " *schwarzii* Coq.
" 15. " *simplicior* Wh. and Mel.
" 16. " *universalis* n. sp.
" 17. " *insularis* n. sp.
" 18. " *calva* n. sp.
" 19. " *agens* n. sp.



MELANDER — TACHYDROMIA

THE INTRODUCTION OF A EUROPEAN SCOLYTID (THE SMALLER ELM BARK-BEETLE, SCOLYTUS MULTISTRIATUS MARSH) INTO MASSACHUSETTS.[1]

By J. W. Chapman.

The Scolytidae are most generally known as bark-borers and consequently many entomologists have given the name of bark-beetles to the entire group. They are a very important group of insects in as much as they are very nearly all tree-feeders. For convenience they might be put into two classes, those that attack our conifers and those that work almost exclusively on our deciduous trees of the forest and shade varieties.

We have found from experience in past years just how important economically are the beetles of the class that infest our conifers, since they have caused a loss of several millions of dollars yearly to different parts of our country.[2] It looks now, from the bark-borer which has recently attacked our elms, as though we were going to have an opportunity to learn of the second class of beetles in the same manner. Europeans have had this problem confronting them for years and it has proved to be one of the most serious with which they have had to deal, because many of these beetles have become such exclusive feeders that they will attack only one kind of tree.

In Germany the most destructive species to elms is the large Elm bark-borer, *Scolytus geoffroyi* Goetze or the "Grosser Ulmen-Splintkäfer" of which Eichhoff gives a good account.[3] He reports that closely associated with it and occurring on the same trees in a peculiarly neighborly or almost symbiotic fashion is the "Kleiner dichtgestreifter Ulmen-Splintkäfer" (*Scolytus multistriatus*). Just what this relationship signifies other than a social tendency of these insects one can hardly say. These two species confine their attacks chiefly to elm trees and considered together they are among the most dreaded pests in elm growing districts. In France the parks and boulevards of

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[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 18.

[2] Hopkins, A. D., Bark beetles of the Genus *Dendroctonus*, Bull. U. S. Bur. Entom., No. 83, pt. 1; The Genus *Dendroctonus*, Bull. U. S. Entom. Tech. Ser., No. 17, pt. 1. (1909).

[3] Die Europäische Borkenkäfer Julius Springer, Berlin, 1881.

Paris have been severely damaged and whole tracts of the elms have been killed.[1] In England the elms of London Park and southern England have been severely injured.[2] We see from this that *Scolytus multistriatus* is very widely distributed in Europe, since, as Eichhoff states, it covers the entire central portion of that continent.

This beetle was first found in the United States and recognized as *Scolytus multistriatus* Marsh in October, 1909, while extensive collections of Leopard Moth larvae were being made from limbs of elms and ash in the College yard, at Harvard. These limbs had to be barked and split for the purpose of securing the larvae of the Leopard Moth, and it was during this process that the *multistriatus* larvae were found. At that time the grubs were about full grown. No live adult beetles were found, but the mother of each brood was found dead in her chamber. A number of these females were extracted in a sufficiently perfect condition to make the identification of the species possible. This identification was kindly made for me by Dr. A. D. Hopkins of the Federal Bureau of Entomology.

After the species was identified I was desirous of knowing to what extent the trees in the surrounding country were infested, and to ascertain if possible about how long the beetles have been in this country. Under ordinary conditions this would have been a difficult matter. But the city of Cambridge was at that time removing from the streets in different parts of the city a hundred or more elm trees which were either dead or in a dying condition. These were all examined. The trunks and larger limbs of the majority of those that were taken out were yet alive. Different parts of the trees were carefully inspected in order to ascertain where the beetles first made their attack. Observations clearly showed that it was invariably above the middle upper part of the trunk, and usually on the larger limbs. The beetles are quite aggressive and as many as two hundred mother beetles were found in a space less than two feet square on a living trunk. Larvae were also taken from the smaller green limbs of standing trees. Without exception every felled tree examined showed hundreds of beetle markings and larvae. A representative number of those standing were carefully examined and nearly every one showed "shot-holes" of the beetles. It is difficult to ascertain the extent of the in-

[1] Barbey, A. Les Scolytides de l'Europe Centrale H. Kündig, Geneva, 1901.
[2] Gillanders, Forest Entomology, 1908.

festation of a standing tree until the bark is removed and this was not feasible. One could only make an estimate from the "shot-holes" that appeared on the external surface.

While making these observations a native American Scolytid, *Hylesinus opaculus* Leconte, which lives only in dead wood, was also found in abundance. Apparently this species has come to assume somewhat the same relation to *S. multistriatus* in this country as *S. multistriatus* does to *S. geoffroyi* in Europe, the only difference probably being that the American species hibernates in the adult beetle stage, while *S. multistriatus* hibernates in the larval stage.

About the middle of November a representative number of trees were examined in the College yard for bark-beetles. It was an exceedingly difficult task as the trees were large, and the "shot-holes" which the beetles make were difficult to locate. The trunks, large limbs and upper branches of each tree selected were carefully gone over. "Shot-holes" of the beetles were found on all of the trees and many of the adult beetles of our American species were busy, making temporary hibernating burrows. These could easily be located by the reddish boring dust which was freshly thrown out. Since these trees were selected in different parts of the yard with a view to making an estimate, I can say that it is quite likely that every tree in the yard harbors some beetles, but just how numerous they are cannot be stated.

I have not been able to follow the complete normal development of these beetles through and therefore do not know positively whether there is one or two broods annually. However, from the observations I have been able to make I feel quite secure in saying that there is only one brood. A number of small limbs which contained adult grubs were collected in October. These have been examined from time to time and up to date there has been no perceptible change in the larvae. The generations of these beetles vary considerably as is seen from the European reports. Eichhoff says that the same species may or may not have two broods annually, depending entirely on its geographical location. Gillanders reports that some of these bark-beetles have two broods in southern and one in northern England. Each of these writers mentions the fact that *S. multistriatus* may have two broods annually though this really seems to be an unsettled question.

Scolytus multistriatus confines itself almost entirely to elm trees, and to such a degree that it is known generally as the "smaller elm bark-beetle." Its habit of attacking injured or weakened trees gives

it practically an unlimited field in which to work as most of our park and shade trees are in a more or less unhealthy state, due to the lack of a proper amount of water and to crowding as well as to many other unfavorable conditions.

The first of December, 1909, some limbs which were about three inches in diameter and showed evidence of containing larvae, were sawed into short pieces and placed in the hot house in large glass jars. To get advantage of a high temperature the jars were placed directly over the steam pipes and kept well covered. Several times a week the pieces of limbs were submerged in water for an instant in order to keep them sufficiently moist so that development might continue. On January 13, 1910, the first adult beetles made their appearance. Some of the limbs were barked and pupae were found in various stages of development. The adult beetles were put into small dishes containing small pieces of fresh elm limbs. The females began almost immediately to make their burrows. When the galleries were about 10 mm. in length I noticed that the males were beginning to loiter about the mouths of the burrows, one male to each opening. Occasionally they would take a hand in removing the boring-dust from the entrance. Very often they would sally forth on a sort of exploration trip which would last only for a few minutes, then they would return to the same opening they had previously left. From two to five days after this relationship had begun copulation took place, and, as was supposed by Eichhoff and others, this occurred at the entrance to the burrow. The time required was from five to ten minutes in the cases observed. Activity was then resumed. The male seldom left the entrance afterwards but kept busying himself removing boring dust. The pairs that mated in this way were isolated with as little disturbance as possible and placed in other dishes in order that daily observations might be made on them. The females continued to excavate their chambers, which in this species are quite straight and always with the grain of the wood. Ten days after copulation I opened the chamber of one of the pairs that had been isolated. On each side of the mother gallery and connecting with it were miniature chambers. In each was a small, shining white egg, securely packed into its place by bits of boring dust. The two parent beetles were placed in another dish with some new elm. In a day or two both were found dead. I then opened the chamber of a second pair of beetles. This one contained eighteen eggs and it was somewhat longer than the first. I removed the parents

to another dish as had been done with the previous pairs. They immediately began work again as if they had never been disturbed.

The manner of excavating the egg galleries and the direction in which they are always made leave a characteristic marking by which the species can always be recognized. This peculiarity is more strikingly brought out when compared with the egg galleries of the other species (*Hylesinus opaculus*) Leconte shown on plate IV, figure 11. In this American species the mother gallery is two-armed and is always made across the grain of the wood. The adult *multistriatus* beetles are small, 2 to 3 mm. long. Thorax black, shining, somewhat longer than broad; elytra pitchy red; antennae and legs light-brown; elytra with close finely punctured striae; abdomen thickly covered with hairs, and viewed sidewise there is a strong horizontal projection on the second segment of the abdomen, which is peculiar to this species. (See plate IV, figs. 7 and 8.) The male is somewhat smaller than the female, with the front flat and thickly covered with hairs. The female has a convex front covered with few hairs, and on the third and fourth segments of the abdomen are prominent toothed projections. The larvae are scolytoid in character (see plate IV, fig. 6). As soon as they hatch the larvae eat their way into the surrounding wood at approximately right angles to the mother gallery (see plate V, fig. 10). When they become full-grown they pupate at the end of their burrow. This takes place according to the European accounts about the first week in May, or a little later. The adult beetles make their appearance in June and July. They come forth at this time in such numbers, says Eichhoff, that large, apparently healthy elms are attacked and completely destroyed in one season.

Since this species is so destructive and our experience with it is so limited, the following remarks, taken from European literature, ought to interest all those who desire to aid in the preservation of our shade elms.

In order to prevent an attack of the bark-beetle it is necessary to remove all centers of infestation from which they might spread to sound trees. Just how feasible this may prove to be depends, of course, on the local circumstances, but whatever care is exercised in other ways, it is very unlikely that much good will be done in lessening attack, so long as the inexcusable practice prevails of leaving trunks of infested elms standing, with the bark still on them, when this contains thousands of grubs which will shortly change to perfect beetles

ready to fly to the nearest growing elms. Scores of just such trunks as these may be seen on the streets and vacant lots of Cambridge and one can without difficulty strip off yards of the bark from them with the hands alone. If this bark is allowed to remain swarming with larvae it is an abiding and serious source of infestation and injury to growing trees. *If property owners would acquaint themselves with this fact, and of the mischief thus caused both to their own trees and to those of the neighborhood, they would undoubtedly take immediate steps to have the bark removed. All dead trees and old trunks with loose bark should have it removed and burned by the first of May, 1910, at the very latest. This will prevent thousands of these beetles from flying to other healthy trees, and thus be the means of protecting them from the attacks of the beetle.*

Observations are to be continued throughout the spring and summer, and a number of experiments will be conducted at the same time. These with further interesting data on the species will be reserved for a later paper.

I wish to express my gratitude to Dr. W. M. Wheeler for the many helpful suggestions which he has given, and to Mr. C. T. Brues for his kind assistance in preparing the plates.

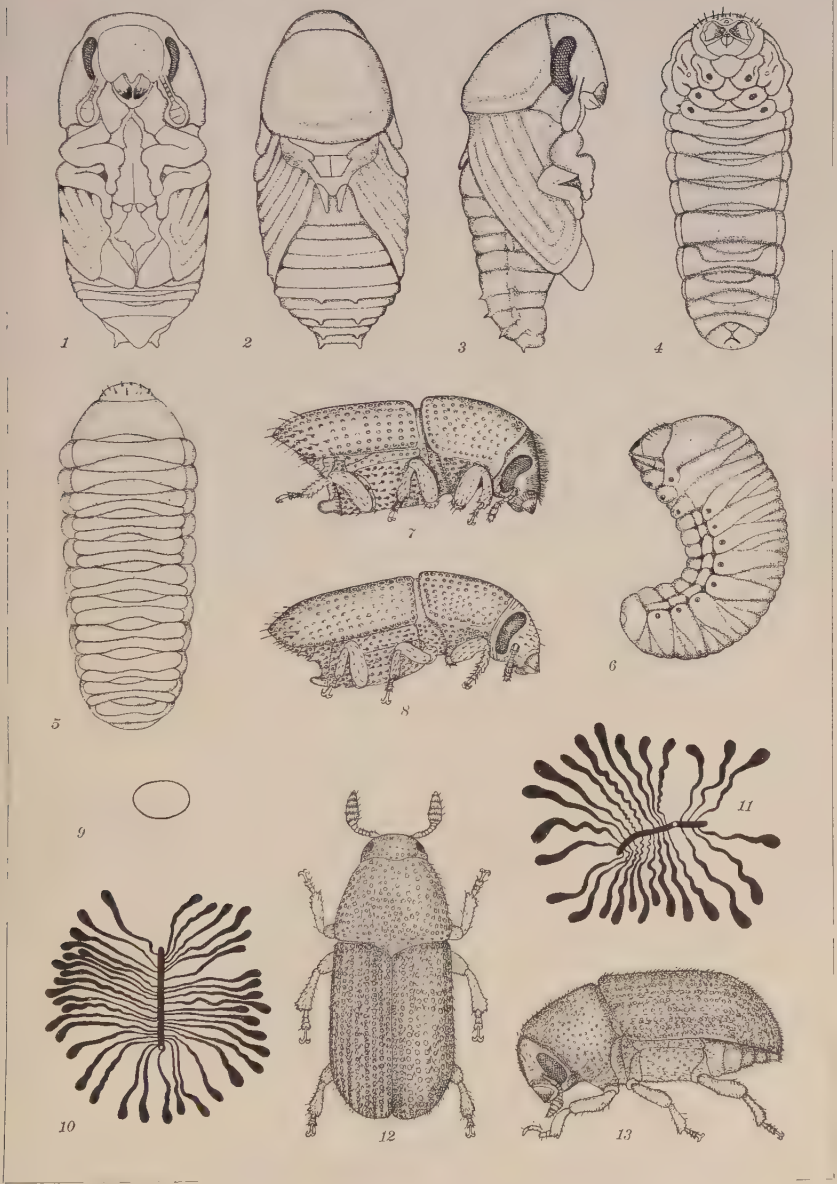
EXPLANATION OF PLATES.

Plate IV.

Fig. 1. Pupa — *S. multistriatus* Marsh.— Ventral view.
Fig. 2. Same — Dorsal view.
Fig. 3. Same — Lateral view.
Fig. 4. Larva — *S. multistriatus.*— Ventral view.
Fig. 5. Same — Dorsal view.
Fig. 6. Same — Lateral view.
Fig. 7. *S. multistriatus* — Male.
Fig. 8. *S. multistriatus* — Female.
Fig. 9. Egg outline, *S. multistriatus.*
Fig. 10. Mother and larval galleries of *S. multistriatus.*
Fig. 11. Mother and larval galleries of *Hylesinus opaculus* Lec.
Fig. 12. *Hylesinus opaculus* Lec. Dorsal view.
Fig. 13. Same — Lateral view.

Plate V.

Fig. 1. Markings of *S. multistriatus* in bark of elm.
Fig. 2. Showing "shot-holes" or exit holes of same.



CHAPMAN — SCOLYTIDAE.

Fig. 1.

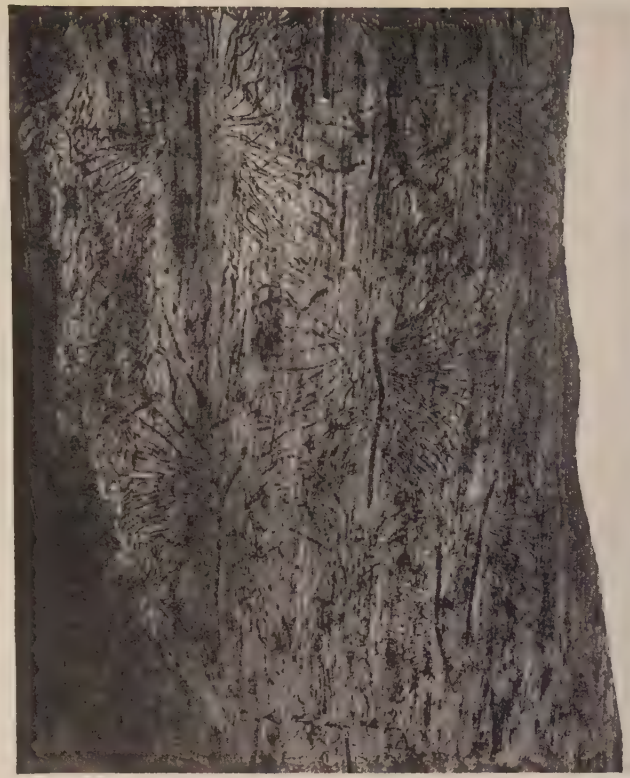


Fig. 2.

CHAPMAN — SCOLYTUS MULTISTRIATUS MARSH.

ON THE RESISTANCE OF GYPSY MOTH EGGS (*LIPARIS DISPAR* L.) TO COLD AND OTHER CONDITIONS.

By William Reiff, Harvard University.[1]

In the "Illustrierte Wochenschrift für Entomologie," Neudamm 1897, N. Kulagin has published a paper entitled "Zur Biologie von Ocneria dispar in Russland," in which the author says that a lowering of the temperature to –40° R. does not have any injurious effect on normally laid eggs of this moth. Eggs which are deprived of their protecting wool, however, will be killed by –15° R. (= –18¾ C.) Concerning the method of procedure in these experiments, Prof. P. Bachmetjew obtained more exact information from N. Kulagin by letters, which he includes in the first volume of his well-known "Experimentelle Entomologische Studien," Leipzig, 1901, p. 70. He says in this place that Kulagin depilated the eggs and left them for one month in a glass dish upon an open balcony. During this time the thermometer not infrequently reached –15° R. In the spring these eggs did not develop, although there were caterpillars hatching from other eggs kept upon the same balcony, but which were attached to a piece of wood with their hair. The question was left open as to the result of leaving eggs covered with hair during the winter in a dish of glass.

I was induced by these investigations to undertake in October, 1908, the following experiment: From dispar egg clusters obtained at Forest Hills, Mass., there were selected five clusters so divided that each egg cluster was separated into three nearly equal parts. One part of each five clusters was attached with good glue to a barky piece of wood and the second thirds of each were lightly pasted to the bottom of five open glass dishes, while the eggs of the last five thirds were entirely depilated and put into five other glass dishes. All three series remained constantly at the outside temperature, but protected from snow and direct contact with water. Two other egg clusters were divided in two nearly equal parts and one part of each cluster was put into a rather small wooden box, from which the cover had been removed. The eggs of the two remaining parts were depilated entirely and then placed separately in two other wooden boxes without covers.

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 17.

All four boxes were sunk into the ground about three centimeters deep in an entirely open and unprotected place where they were allowed to remain. Snow and water were allowed free admittance to the eggs, but care was taken to allow the water to run off to a slight extent by means of a few very small holes which were cut in the bottom of the boxes.

A self-registering thermometer used recorded –21.5° C. as the lowest temperature of the winter 1908–09.

During the latter part of May, 1909, *the caterpillars from the eggs of all the series began to hatch simultaneously.* An examination made of all eggs which failed to hatch showed that *all* parts of the individual egg clusters presented about the same very small proportion of empty, dead or dried eggs, in each case a percentage of 5–8%.

The first result obtained which deserves notice, is the fact that the series of eggs which were deprived of their protecting hairs and passed the whole winter in glass dishes, withstood the cold just as successfully as those which had overwintered on a piece of wood covered with hairs in the normal way. If in Kulagin's experiment, the depilated eggs died which were exposed to the winter temperature for only one month in a glass dish probably the stated maximum temperature of –15° R. was more frequently reached, as Kulagin says himself, and perhaps also the temperature remained more constant. A continuous low temperature, however, did not occur in this locality during the winter of 1908–09, during which the temperature often fell very low but always rose again. It appears from this that the dispar eggs, from which the woolly covering has been removed, can withstand quite severe cold without injury, provided that this temperature does not endure too long. Or perhaps may it be that the woolly covering of the eggs laid by the female dispar, which withstand the very cold winter of Russia is stronger and thicker than we find here? If this be the case, the depilated eggs of Russian masses should exhibit a slighter resistance, for the eggs on account of the thick covering should be less accustomed to cold.

How very resistant the dispar eggs may be to the various influencing factors of the winter, is shown by the last two series of experiments, in which even depilated eggs withstood snow and water as well as low temperature without damage. To consider the practical application of these experiments, it appears that dispar eggs which have been removed from their normal location through some accident and have

fallen singly to the ground, can easily withstand the winter even without their protective covering. Simply tearing off the eggs from their attachment, which is occasionally done in private yards and similar places, has absolutely no effect in killing the eggs.

In connection with these experiments something may be said concerning the sporadic diffusion of the Gypsy moth in the New England States. As is well known, *Liparis dispar* frequently makes its appearance in places far removed from any sort of traffic, for example in the middle of a wooded area, in which any introduction by railroads, vehicles or other means of transportation is entirely excluded. There has hitherto been no explanation of the way in which the gypsy moth reached these isolated places. I will pass over the supposition, which one hears here and there, but which cannot be taken seriously, that birds drop caterpillars, which they have previously picked up, and thus aid in the spread and dissemination of the gypsy moth. In the first place, a caterpillar which had been dropped from the bill of a bird, would be in so very few cases so slightly injured that it could develop into a moth, and in the second place, at least one male and one female caterpillar would have to be dropped in precisely the same place to provide for the possible establishment of a dispar colony. Also the explanation of dissemination by the dropping of a fertilized gravid dispar female in the same manner is not at all plausible. The dispar females almost always deposit their eggs immediately after fertilization has taken place, so that the chance of birds capturing a fertilized female with eggs is very improbable. Furthermore a dropped dispar female, injured by a bird's bill would hardly be able still to lay its eggs.

Lately there has appeared in the fifth edition of the "Naturgeschichte der deutschen Vögel" by C. G. Friderich, Stuttgart, Verlag für Naturkunde Sproesser & Nägele, 1905, a highly interesting paper by Alexander Bau "Ueber Nutzen und Schaden der Vögel und über Vogelschutz." A short report of this article is given in No. 35, Vol. XVIII of the "Entomologische Zeitschrift," Guben (Germany) 1905. As a result of very exact investigations, which the author undertook and for which he was particularly well fitted through his extensive experience as entomologist as well as ornithologist and forester, Alexander Bau reached the conclusion that the assumed economic benefit of insectivorous birds should be constantly questioned. The part of his paper of perhaps the greatest interest deals with examinations of the

stomachs of the birds and experiments made as a direct result of these. Thus Bau has found in the stomachs of jays (Eichelhäher) egg-masses of *Malacosoma neustria* (German Tent caterpillar), eggs of Orgyia antiqua (German Tussock moth), eggs of *Psilura monacha* (the "Nun" of the Germans), together with eggs of other Bombycid moths. He has proved by various experiments that all these eggs pass out *undigested*, protected by means of their extremely hard chitinous shells and remain *in a living state*. Therefore the author naturally concludes that birds even help to propagate injurious insects. In this way Bau's experiments furnish an explanation for the sporadic distribution of the gypsy moth, which is, as is known, a close relative of the European *Psilura monacha*. Dispar eggs have exceedingly strong chitinous shells also, which are undoubtedly resistant in the same manner against the decomposing action of the digestive juices of the birds' stomachs.

The Green Bug and its Natural Enemies, A Study in Insect Parasitism. By S. J. Hunter. Bull. Univ. Kansas, Vol. 9, No. 2, pp. 163, figs. 48, Pls. 9, October, 1909.

This extensive paper deals with the relations existing between *Toxoptera graminum*, the Green Bug and its parasite, *Lysiphlebus tritici*, and deals in great part with the successful artificial dissemination of the parasite in Kansas. It contains however, much good biological matter concerning both species, particularly the parasite which was extensively studied experimentally with regard to its variation, reproduction, habits at different temperatures, etc. Much is added to our knowledge of the bionomics of *Lysiphlebus*, and one remarkable conclusion reached is worthy of special mention. It was found that parthenogenetic *Lysiphlebus* produce almost entirely males, but that a very small proportion of females regularly appear among such offspring. Unfortunately the report contains a considerable amount of controversial matter and numbers of detailed tables are printed at great length where it would seem that short summaries might have served the purpose much better.

C. T. B.

SMALL ARTIFICIAL ANT-NESTS OF NOVEL PATTERNS.

By William Morton Wheeler,
Harvard University.

The study of the behavior of ants, which is attracting an ever increasing number of investigators, has led to the invention of several different patterns of artificial nests. Those used by the older writers, such as Swammerdam[1], Pierre Huber[2] and Lubbock[3] contained earth, and some of the more modern nests recommended by Wasmann[4] and others also contain this substance. A new departure was initiated by Janet[5] in his plaster of Paris nests and by Miss Adele M. Fielde in the glass nests which she has devised[6], since both of these investigators dispense with earth as an untidy, and superfluous accessory. Veihmeyer[7] has suggested some improvements in the construction of the Janet nest, and Miss Buckingham[8] and I[9] have endeavored to introduce certain modifications in the structure of the Fielde nest; Miss Buckingham substituting aluminum for the glass base, thus greatly diminishing its weight, while I have substituted plaster of Paris, thus combining the principles of the Janet and Fielde nests and facilitating construction. Emery[10] has very recently published an account of a modification of the Janet nest, which, owing to its cheapness and durability, and the ease of its construction, merits the attention of all those who are studying living ants in the laboratory. I subjoin a translation of his directions for making this piece of apparatus.

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[1] Biblia Naturæ, Leyden 1737.

[2] Recherches sur les mœurs des Fourmis indigènes. Paris et Genève, 1810.

[3] Ants, Bees and Wasps. Rev. Ed. Internat. Sci. Ser. N. Y. Appleton & Co., 1894.

[4] Die psychischen Fähigkeiten der Ameisen. Zoologica XI, 26, 1899, 132 pp. 3 pls. Rev. Ed. 1909, 188 pp. 5 pls.

[5] Appareil pour l'Élevage et l'Observation des Fourmis. Bull. Soc. Zool. France, XVIII, 1893, pp. 168–171; Appareils pour l'Observation des Fourmis et des Animaux myrmécophiles. Mém. Soc. Zool. France X, 1897, 22 pp., 3 figs., 1 pl.

[6] Portable Ant-Nests. Biol. Bull. II, 1894, pp. 81–85, 3 figs; Portable Ant Nests, ibid., VII, 1904, pp. 215–220, 1 pl. 2 figs.

[7] Beobachtungsnester für Ameisen, "Aus der Heimat," 1905, Heft 1, 11 pp., 6 figs.

[8] A Light-weight, Portable Outfit for the Study and Transportation of Ants. Amer. Natur., Oct. 1909, pp. 611–614.

[9] On the Founding of Colonies by Queen Ants, with Special Reference to the Parasitic and Slave-making Species. Bull. Amer. Mus. Nat. Hist., XXII, 1906, pp. 33–105, 7 pls., 1 fig.

[10] Kleine Künstliche Ameisennester, Zeitschr. f. wiss. Insektenbiol. V, 1909, p. 403.

"This summer I have used a style of artificial nest which is excellently adapted for experiments on a small or very small scale, e. g. for making observations on single fertilized queens while they are founding their colonies. These nests have, moreover, the advantage of being extremely cheap and easy of construction.

"I make these nests from hollow tiles, such as are used in building light walls. These tiles, which are perforated with holes, are sawed, at right angles to the holes, into plates of the required thickness. Since the saw is soon blunted by this operation, I use an old one that is more or less worn.

"Then I have each plate ground down till it is smooth on both sides. On one of these sides, which is to become the floor of the nest, I fill in the openings with plaster of Paris, and the other side is covered with a glass plate of suitable dimensions. The cavities can then either be left as so many separate chambers or connected with one another by means of grooves, or even have one of their walls perforated with a glass tube to serve as a communication with some other piece of apparatus. One of the chambers can be used as a water reservoir (as in the Janet nests) and remain isolated while the others are made to communicate with one another by means of grooves.

"A convenient method of supplying these nests with the requisite amount of moisture is to place them on a layer of damp moss.

"Plates of hollow tiling may also be conveniently employed as porous and quickly drying bases for ordinary Janet nests, as their lower surfaces are thereby prevented from becoming mouldy."

A small artificial nest of still a different pattern is employed by Dr. F. Santschi of Kairouan, Tunis, in his studies on colonies of diminutive ants which have to be kept in very tight receptacles. He described its construction to me in the course of a conversation, which I had with him in Lausanne during the past summer, as follows:

The base of the nest consists of a rectangular glass plate, such as is most conveniently obtained by cleaning an unsuccessfully exposed photographic plate of ordinary dimensions, say 3×4 or 4×5 inches. Wet plaster of Paris is poured onto this plate in the form of the heavy lines in the accompanying diagrams, which represent nests with two and three chambers respectively, connected by galleries. Of course, any other design which suggests itself as suitable, may be used instead, if desired. Before the plaster has set, a second glass plate of the same size and shape as the base and previously covered with a film

of sweet oil is pressed down onto the plaster till it forms walls only a few millimeters in height. After the plaster has set, the roof-pane is removed, cleaned and cut into two or more pieces with a diamond along lines (dotted in the figures) which bisect the short galleries, and then replaced as covers of the chambers. The ants can be introduced into the nest by sliding the covers apart a short distance over one of the galleries. The plaster is sufficiently porous to provide for ventilation and a thin slice of wet sponge or a tuft of wet moss or cotton, placed in one of the chambers, will furnish the requisite amount of moisture. Nests of this description are very useful as they can be placed on the

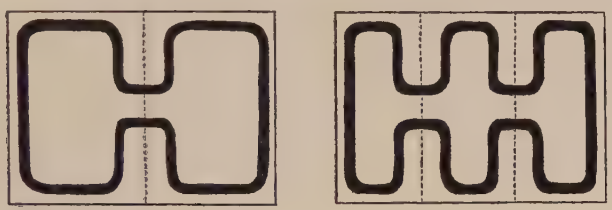

Fig. 1. Diagrams of nests devised by Santschi.

stage of the compound microscope, or preferably of the Zeiss binocular and their inhabitants studied under a low objective. Santschi recommends his nests for the study of such small ants as the various species of *Leptothorax*, *Myrmica*, *Tapinoma*, *Bothriomyrmex*, *Myrmecina*, *Stenamma*, *Goniomma*, *Oxyopomyrmex*, etc., and their parasites and myrmecophiles, but they would be equally useful for very small colonies of larger ants and for studies on the foundation of colonies by single queens, not to mention all observations in which a few workers are to be kept in isolation for some purpose. These nests can be so easily and rapidly made that they will prove to be very useful for travelers.

A NOTE ON THE SPECIES OF FUCELLIA OF EASTERN NORTH AMERICA.

By Charles W. Johnson.

I have been greatly interested in the paper by Prof. P. Stein, "Zur Kenntnis der Gattung Fucellia Rob. Desv.," (Wiener Entom. Zeit., XXIX, p. 11, 1910). A study of all the material at hand (over 60 specimens), shows that all are referable to *Fucellia marina* Macq. and not to *F. fucorum* Fall. In referring to the distribution of the latter in Europe, Prof. Stein says:— "The true *F. fucorum*, as Lundbeck comprehends in his "Diptera groenlandica," is found very rarely on our German coasts and belongs more to the far North. I did not find it in any collection of my dipterological friends, for all that were sent to me under the name fucorum belonged to *maritima* Hal. I myself caught only a single male in Thiessow on the Island of Ruegen, together with *maritima* Hal. But as I took with it comparatively few specimens, that I at that time held for the same species, it is possible that after all *fucorum* is also more abundant on Ruegen. On our Baltic coasts I have never yet observed it. When Lundbeck declares that the species is spread over the greater part of Europe as far as Trieste, this rests on the assumption that the *fucorum* quoted by the author is Fallen's species, which is, in fact, not the case. Aside from a type of Lundbeck's, specimens are before me that were caught in Alaska (St. Paul Isl.), Friday Harbor (Washington, U. S.), and in Behring Str. (Miednaja)."

Among some diptera obtained by several collectors in Labrador and Newfoundland I find only *F. marina*. Still there is little doubt but that *F. fucorum* is to be found on those shores, but very doubtful if it will be found as far South as New England. The following table comprises the four species from Eastern North America:—

MALES.

1. Posterior femora on the underside at the base with a thick tuft of short bristles, apex of the wing not clouded. 2
   Posterior femora without the thickened tuft of bristles at the base, but on the underside along the whole length with rather strong bristles of nearly equal length, apex of the wing clouded. . . . . **pictipennis** Beck.

2. Middle tibiae without bristles on the inside, tibiae and palpi for the greater part reddish yellow, rarely darkened.....**marina** Macq.
   Middle tibiae on the inside with one or two distinct bristles, palpi and legs entirely black.....3
3. Posterior femora only on the underside with a rather small bristle tuft, halteres blood red.....**ariciiformis** Holmgr.
   Posterior femora in addition to the bristle tuft, on the underside with a knob-like swelling turned toward the body and set with short bristles, halteres yellow.....**fucorum** Fall.

FEMALES.

1. Tibia for the most part yellow, tarsi and femora for the most part black, middle femora on the underside only with very fine, short hairs. **marina** Macq.
   Tibiae for the most part black.....2
2. Posterior lower sternopleural bristles wholly wanting or only indicated by a quite fine short hair, apex of the wing distinctly clouded. **pictipennis** Beck.
   Posterior lower sternopleural bristles distinct even if short, apex of wing not clouded.....3
3. Middle femora only on the underside behind with a few longer bristle-like hairs, halteres yellow.....**fucorum** Fall.
   Middle femora not merely on the underside behind, but also on the underside in front with several comparatively strong bristle-like hairs, halteres blood red.....**ariciiformis** Holmgr.

A study of all the original descriptions of the species suggested as synonyms by Prof. Stein, seems to point conclusively to the fact that the synonymy will have to stand as follows:—

Fucellia marina Macquart.

Scatophaga marina Macq., Ann. Soc. Ent., France, VIII, 242, pl. 11, fig. 3. Oct., 1838.

Scatophaga (*Halithea*) *maritima* Haliday, Ann. Nat. Hist., II, 186, Nov., 1838.

Fucellia arenaria Desv., Ann. Soc. Ent., France, X, 272, 1841.

Fucellia intermedia Lundbeck, Dipt. Groenl.,— Videns. Meddel. Nat. Foren., Kjoebenhaven, 1901, p. 291, fig. 1 b.

Fucellia maritima Stein, Wiener Ent. Zeit., XXIX, 18, 1910.

In referring to the synonymy in his introduction, Stein shows that the type of Fucellia is *F. arenaria*, the only species mentioned by Desvoidy under his generic diagnosis, and suggests that Desvoidy's statement that the female has the tuft of bristles on the posterior femora was undoubtedly a slip of the pen. Prof. Stein further states

(as Mik has also done), that there are a number of species of *Fucellia* in which the posterior femora are simple in both sexes, and which yet belong to *Fucellia* beyond a doubt.

The specimens before me show the following distribution:—Great Caribou Isl., Labrador, July 14th (G. M. Allen); Caribou Isl., Lab., (Packard); Funk Isl., Newfoundland, July (Owen Bryant); Eastport, Me., July 15 (Johnson); Dover, N. H., April 11 (Bridwell); Hampton, H. N. (Shaw); Beverly, Mass., April 24 (A. P. Morse); Framingham, Mass., June 6 (Frost); Cohasset, Sept. 8 (Bryant); Fall River, Mass., April 20 (N. S. Easton); Kingston, R. I., March 27 (Barlow); New Haven, Conn., Nov. 9 (Viereck); Clemonton, N. J., April 15, and Philadelphia, Pa., March 12 (Johnson); Bermuda, March 6 (F. M. Jones); St. Augustine and De Funiak Springs, Fla., March 1st (Johnson); Charlotte Harbor, Fla. (Mrs. Slosson).

From the Pacific Coast Prof. Stein has described five new species:—*Fucellia bicruciata*, Behring Strait; *F. costalis*, Monterey, Cal.; *F. antennata*, Alaska; *F. separata*, Monterey, Cal. and Seattle, Wash., and *F. rufitibia*, Pacific Grove, Cal.

The Mating Habits of Empididae. Hamm, A. H. Observations on *Empis livida* L. Ent. Month. Mag. XIX, pp. 181–184; Observations on *Empis opaca* F., Ibid., XX, pp. 132–134; Further Observations on the Empinae, Ibid., XX, pp. 157–162.

It appears to be the regular occurrence among many species of *Empis*, and also in at least some species belonging to *Pachymeria* and *Rhamphomyia*, for the males to capture small Diptera and other insects which they paralyze with their beaks, and then offer to the females to feed upon during copulation. The male does not appear to partake of this food itself and simply offers it to the female which devours it while pairing. Several other species of *Empis* were found to copulate without prey, and females of these were found feeding at other times, although those which copulate with prey were not found to feed at other times.

C. T. B.

A HOPPERDOZER FOR ROUGH GROUND.

By Albert P. Morse, Wellesley, Mass.

During the last few years a large part of New England has been subjected to a series of extremely dry summer seasons. This climatic condition is favorable to the development of locusts or "grasshoppers" in itself, and at the same time diminishes the ravages of fungous diseases which tend to hold them in check, and stunts the vegetation on which they feed. As a natural consequence several species have multiplied to such an injurious extent, at least locally in parts of Vermont, New Hampshire, and Maine, that it is wise to consider means of artificial control.

Of the various methods of fighting grasshoppers which become locally injurious, two are of especial importance:— viz., 1st, plowing of the breeding-grounds before they hatch (or immediately thereafter), thereby burying and destroying them; and 2nd, destruction of the young before they have done much injury or are able to travel far.

Where the breeding-grounds are not now known, or an extended watch cannot be kept at hatching-time and immediate action taken, the first method cannot be considered available for the coming season. Or again, the breeding-grounds may be of such a character that plowing of them is impracticable, either by reason of their stoniness, steepness, location, or the injury which would result from washing by rains.

The second method of control — destruction of the young — may be effected under some circumstances by poisoning the vegetation in and near the hatching grounds, with arsenicals, or by the use of poisoned baits such as bran-mash or dried horse-droppings, both of which are attractive to the young 'hoppers. The use of arsenicals in pastures, however, is impracticable, and it is probable that by far the larger part of the New England breeding-grounds are used for that purpose. Another very effective method of destroying the young is by the use of "hopperdozers," long, flat, shallow pans containing kerosene or kerosene and water, which are drawn by horses over the infested fields and into which the young locusts leap and are destroyed. These, however, can be used effectively only on relatively level ground and have the disadvantage of imparting to the forage a flavor decidedly repugnant to stock. A hopperdozer to be of use in New England

should be free from this defect and should be of such construction as to allow it to be used on very uneven ground.

Freedom from repugnant odor can be secured by substituting for the coal-oil pan a piece of sheet-iron or other flat surface smeared with a suitable adhesive substance of which we have at hand an excellent one in what is known as "Tree Tanglefoot," largely used to prevent caterpillars of the gypsy-moth and canker-worms from ascending trees. A young grasshopper falling upon a surface coated with this preparation is there to stay.

The second need — adaptability to an uneven surface — may be secured by constructing the machine in sections, say two-and-a-half

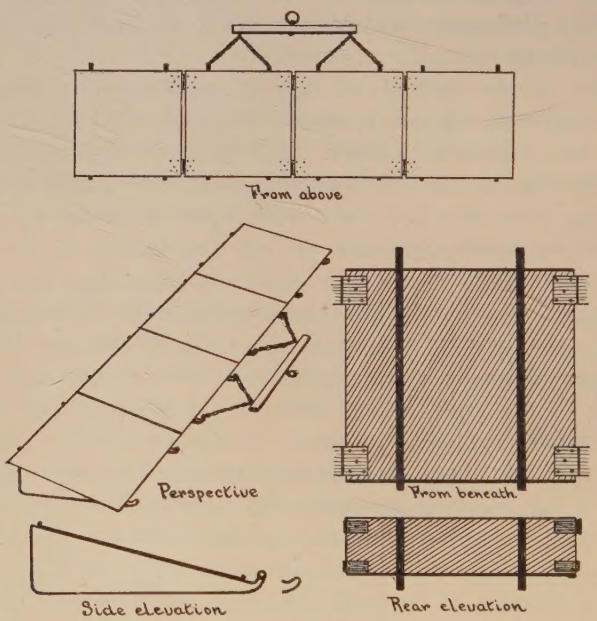

Fig. 1. For destroying grass-insects on rough ground where the use of kerosene is objectionable and the ordinary form of machine cannot be used. Designed by A. P. Morse.

or three feet long, hinged so as to be freely movable on each other, thus allowing a much closer approximation to the surface of uneven ground than is possible with a rigid pan or plate ten or twelve feet in length. The following sketches illustrate such a device, made of No. 24 galvanized sheet iron in four sections, with iron or steel runners,

so constructed as to allow considerable movement in a vertical plane, and even a folding-over of the end-sections on the middle ones for convenience in transportation. Such a machine can be readily made by a handy blacksmith, or a substitute therefor may be built of boards by any farmer, the principle remaining the same. The front and rear edges of the iron plates should be stiffened with iron rods, and the front edge should be about two inches from the ground. The runners should be of such form as to pass over minor obstructions on the ground and to permit movement backwards, for convenience.

Such a machine, properly coated with "Tree Tanglefoot" and drawn by a horse over pasture and mowing-lands during the early stages of development of the 'hoppers would capture them in large quantities, and in addition destroy myriads of leaf-hoppers (Jassidae), spittle-insects (Cercopidae), plant-bugs (Capsidae), and other grass- and grain-inhabiting insects.

A Monographic Revision of the Twisted Winged Insects Comprising the Order Strepsiptera Kirby. By W. Dwight Pierce, Bull. U. S. Nat. Mus., No. 66, pp. 232, pls. 15; figs. 4. (Dec. 1909.)

This extensive contribution represents the first attempt made to gather together and correlate the considerable amount of scattered information at present available concerning this most aberrant and interesting group of insects, and in addition it contains a large amount of new matter, relating principally to the North American members of the order.

The Strepsiptera are regarded as an order, a view which will probably receive the endorsement of other workers, although there are some such striking similarities between them and Rhipiphorid Coleoptera that it is difficult to regard them with Pierce as more closely related to the Hymenoptera and Diptera. One point upon which much stress is laid, the presence of the group in Baltic amber of Tertiary age, cannot carry conviction, for we know that in other specialized orders many amber species are almost indistinguishable from living ones.

Following his preliminary classification of the Strepsiptera published in 1908 [1] the author divides the order into four superfamilies

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[1] A Preliminary Review of the Classification of the Order Strepsiptera, Proc. Ent. Soc. Washington, Vol. IX, pp. 75–85.

to make its classification accord with that which has been proposed for some of the other orders of insects, but owing to the compact nature of the group he has been compelled to select slight, single characters, and each superfamily differs from the one preceding it by the loss of one tarsal joint in the male. Similarly the eight families are segregated by the number of joints and form of the flabella of the antennae. Due to the extremely degenerate form of the females, still less evident characters are available for their classification. It seems unfortunate that such a very ambitious and cumbrous grouping should have been adopted for it can hardly fail to confuse the student who is not a specialist in the order, and to make it appear out of its proper proportion in the taxonomy of insects in general.

103 species are listed and described, belonging to 37 genera, 24 of which are monotypical, while 45 or nearly half the species belong to two genera. 69 of the species, all but 7 of which are from North America, are described as new. Many of the species known from only females or single specimens appear to be very closely related, and Pierce assumes that each parasite species can be defined by its host species. Time only can tell whether such a supposition is correct, but the more definite knowledge which we have concerning other parasitic insects shows that such generalizations should not be made too hastily, especially when they relate to the genera of hosts and parasites. A case of such association is the genus *Homilops* where species known only by females are segregated with one known only by the male on account of their hosts being congeneric.

In addition to many figures, there are full descriptions of all new species, and collected literature relating to all exotic ones, as well as a very complete compendium of the known facts regarding the development, anatomy, and ethology of the group. This will form a splendid basis for future work, which it is to be hoped will be undertaken by many entomologists.

A very extensive bibliography of fifteen pages completes the paper. Some of the references will appear superfluous to working naturalists, however, such as yearly citations of the Zoological Record, and the Zoologischer Anzeiger, and the inclusion of the Century Dictionary.

C. T. Brues.